Docket No.: 050195-0376 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Osamu SHIMAMURA, et al.	:	Confirmation Number: 3790
Application No.: 10/622,511	:	Group Art Unit: 1745
Filed: July 21, 2003	:	Examiner: LEE, Cynthia K.

For: AUTOMOBILE CELL AND RELATED METHOD

Declaration Under 37 C.F.R. § 1.132

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Takaaki Abe, declare as follows:

1. I received a Master's Degree in Thermal Energy Engineering from Kyushu University in 1989.

2. My field of specialty is electrochemical cells for electric vehicles.

3. Since 1989 I have been employed by Nissan Motor Co., Ltd.

4. I have been engaged in research on electrochemical cells for electric vehicles since 1994.

5. I am an inventor of U.S. Patent Application Serial No. 10/622,511, AUTOMOBILE CELL AND RELATED METHOD, filed July 21, 2003 (the present invention).

6. Co-inventor Osamu Shimamura and I fabricated and tested automobile cells with various terminal lead widths as explained below.

7. Flat automobile cells 1, as illustrated in Fig. 1 of the present specification, were fabricated in a structure wherein the circumferentially peripheral portions of the cell outer sheath material 3 made of polymer-metal composite laminate film with a thickness of 120 μm were joined by thermal welding and the positive electrode terminal lead 7 and the negative electrode terminal lead 8 with respective thicknesses T3, T3' of 100 μm and respective widths L5, L5' of 6.5, 13, 19.5, 26, 32.5, 39, 45.5, 52, 58.5, 65 mm extending from the opposing sides of the respective thermally welded portions 2.

8. Positive electrode plates 4, as illustrated in Figs. 3, 4A, and 4B of the present specification, were fabricated with a positive electrode current collector 4a, made of aluminum foil that having a thickness T4 of 15 μm and coated with a slurry including the positive electrode active substance 4b of $LiMn_2O_4$ and, in addition thereto, a mixture of PVdF, serving as the binder, and acetylene black serving as the electrically conductive promoting agent and the thus obtained plates were dried to form the positive electrode active substance layers 4b on both sides of the positive electrode current collectors 4a. The thickness T2 of the positive electrode active substance layer 4b was 60 μm. The thus obtained positive electrode plate 4 was cut in a rectangular shape of a surface area of 300 cm^2.

9. Negative electrode plates 5, as illustrated in Figs. 3, 4A, and 4B of the present specification, were fabricated into a structure wherein the negative electrode current collector 5a, made of copper foil with a thickness T4' of 15 μm, was coated with a slurry including a mixture of the negative electrode active substance 5b of amorphous carbon, which was able to occlude and eliminate lithium ions, and PVdF serving as the binder and the thus obtained plates were dried to form the negative electrode active substance layers 5b on both sides of the negative electrode current collectors 5a. The thickness T2' of the negative electrode active substance 5b

was 60 μm. The thus obtained negative electrode plates 5 were cut in a rectangular shape of a surface area of 300 cm^2.

10. Polypropylene separator 6, as illustrated in Figs. 3, 4A, and 4B of the present specification, having a thickness of 25 μm was used in the automobile cells.

11. Electrolyte composed of solvent containing PC-DMC mixed at a molar ratio of 1 : 1 dissolved with 1 (mol/L) of $LiPF_6$ was used in the automobile cells.

12. Six sheets of the negative electrode plates 5 and five sheets of the positive electrode plates 4, and the separator 6 were sandwiched and stacked in sequence between the negative electrode plate 5 and the positive electrode plate 4. The separator 6 was also disposed outside of each of the uppermost and lowermost negative electrode plates 5, as shown in Fig. 3, forming an electric power generating element 9a to which the positive electrode terminal lead 7 and the negative electrode terminal lead 8 having the respective thicknesses T3, T3' of 100 μm and the respective widths L5, L5' of 6.5, 13, 19.5, 26, 32.5, 39, 45.5, 52, 58.5, 65 mm were connected. The resulting electric power generating element 9a was then encapsulated in the laminate film cell outer sheath material 3 whereupon the circumferentially peripheral portions of the cell outer sheath material 3 were thermally welded to hermetically seal the electric power generating element 9a, and the electrolyte was poured, by means of an injector, into the flat automobile cell 1, thereby fabricating the flat automobile cell 1.

13. The value T1/(T2 + T2'), obtained by dividing the maximum cell thickness T1 by the active substance thicknesses T2 + T2' of the electrode active substances 4b, 5b of the unit electrode plates 4, 5, was 15, and the value S7/CB, obtained by dividing the unit cell surface area S7 by the cell capacity CB, was 176 cm^2/Ah. The cell capacity CB was obtained by the product of discharging current x discharging time when discharging the cell 1 at the 1 C rate in the range

from 4.2 V to 2.5 V. The thus obtained flat automobile cell 1 had a size of L6 (= L6') x L9 x T1 = 65 mm x 200 mm x 1800 μm, as illustrated in Fig. 5 of the present specification.

14. Specifications for the fabricated flat automobile cells 1 are given in Table 1:

		Maximum cell thickness	Average thickness of active substance of unit electrode	A/B	Material of terminal lead	Max. length (L9) of a side other than one side from which terminal lead is taken out (mm)	Unit cell surface area	Cell capacity
		(μm)	(μm)	(dimensionless)			(cm^2)	(Ah)
		(A: T1)	(B: T2, T2')				(C: S7)	(D: CB)
Experiments	1	1800	120	15	+Al/-Ni	200	300	1.7
	2	1800	120	15	+Al/-Ni	200	300	1.7
	3	1800	120	15	+Al/-Ni	200	300	1.7
	4	1800	120	15	+Al/-Ni	200	300	1.7
	5	1800	120	15	+Al/-Ni	200	300	1.7
	6	1800	120	15	+Al/-Ni	200	300	1.7
	7	1800	120	15	+Al/-Ni	200	300	1.7
	8	1800	120	15	+Al/-Ni	200	300	1.7
	9	1800	120	15	+Al/-Ni	200	300	1.7
	10	1800	120	15	+Al/-Ni	200	300	1.7
		C/D	Thickness of electrode terminal lead	Total thickness: positive/negative electrode current collectors	E/F	Width of terminal lead	Length of one side of laminate film (mm)	G/H ×100 (%)
		(cm^2/Ah)	(μm)	(μm)	(dimensionless)	(mm)		
			(E: T3, T3')	(F: n ´ T4/m ´ T4')		(G: L5, L5')	(H: L6, L6')	
Experiments	1	176	100	75/90	1.3/1.1	6.5	65	10
	2	176	100	75/91	1.3/1.1	13	65	20
	3	176	100	75/92	1.3/1.1	19.5	65	30
	4	176	100	75/93	1.3/1.1	26	65	40
	5	176	100	75/94	1.3/1.1	32.5	65	50
	6	176	100	75/95	1.3/1.1	39	65	60
	7	176	100	75/96	1.3/1.1	45.5	65	70
	8	176	100	75/97	1.3/1.1	52	65	80
	9	176	100	75/98	1.3/1.1	58.5	65	90
	10	176	100	75/99	1.3/1.1	65	65	100

Table 1

15. Discharge tests were conducted on the fabricated automobile cells. The automobile cells underwent 100 discharge cycles, where one cycle for one minute involves a discharging cycle for 5 seconds and a shutdown for 55 seconds. The cell temperature increase was measured, recorded in Table 2, and plotted in Exhibit 1.

% (D/65 cm)	10	22	30	40	50	60	70	80	100	
dT [° C]	480	99.2	53.4	30	19.2	13.3	9.8	7.5	4.8	
Sealing defective rate (dimensionless)								0	1.7	

Table 2

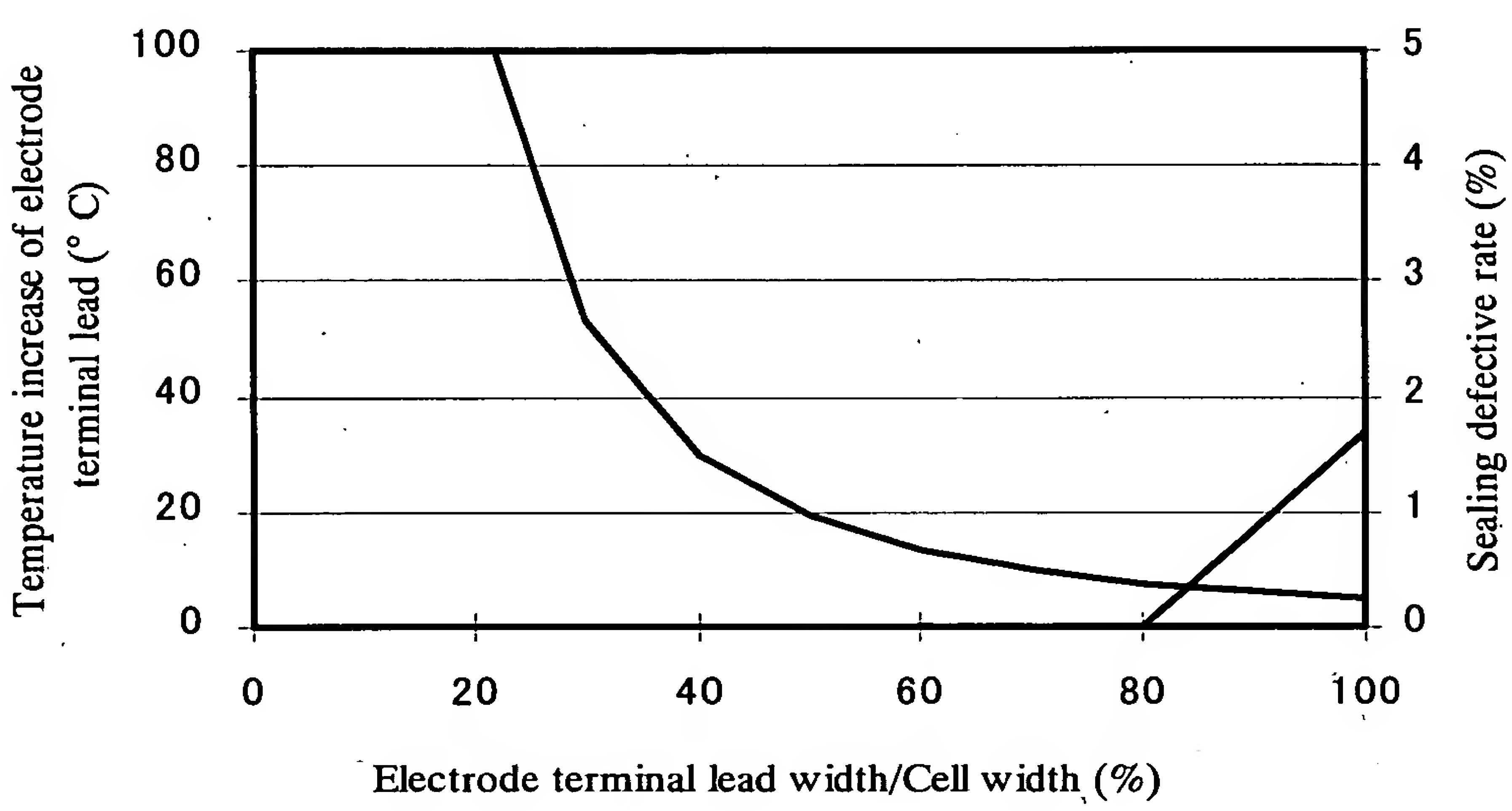

Exhibit 1

Exhibit 1 shows a percentage (%) of electrode terminal lead widths L5, L5'/cell width {lengths L6, L6' of a side of cell outer sheath material 3, from which side the electrode terminal leads 7, 8 are taken out}, relative to temperature increase of electrode terminal leads, 7, 8 and sealing defective rate (%). The temperature increase of the automobile cells was measured by mounting a thermocouple to the surface of the automobile cells and the 5-sec discharging was

conducted by 100 cycles at the 20 C rate. In Exhibit 1, the maximum temperature increase (° C) of the electrode terminal leads 7, 8, as illustrated in Fig. 5 of the present specification, relative to the temperature of the electrode terminal leads 7, 8 before the measurement.

16. The measurement of the sealing defective rate was conducted by storing three automobile cells from each of the experiments 1 to 10 in an atmosphere of 40° C (with no humidity control) for sixty days and, thereafter, the presence of or absence of leaked solvent from the automobile cells was confirmed visually and through the use of litmus paper. The sealing defective rate D (%) was calculated on the basis of a ratio of the number of automobile cells, which suffered from leakage of liquid, with respect to a total number of automobile cells. The sealing defective rate data is provided in Table 2.

17. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of this application or any patent issuing therefrom.

2/25 /2008
Date

Takaaki Abe
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